E & A

U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1337

DISEASES OF POULTRY

- 3 MAR. 19
ENTON
DEPARTMENT OF AGRICULTURE
3 OCT 1923
LONDON, ENGLAND

CHICKENS, turkeys, ducks, geese, and pigeons are susceptible to many diseases, some of which are highly infectious. Disease germs pass rapidly from bird to bird of the flock, and may be carried by one means or another to neighboring flocks, producing extensive outbreaks, or epizootics.

Certain diseases respond favorably to treatment. Others resist all efforts at treatment and cause very heavy losses.

Preventive measures properly applied offer the surest means of controlling diseases of domesticated birds.

It is necessary that the poultry owner be enlightened as to the characteristics of the more important diseases in order that he may intelligently use the most approved methods of combating them.

Sanitary and other measures which have been found successful in the control of poultry diseases may, if properly applied, materially reduce the great annual losses in flocks.

Washington, D. C. Issued July, 1923

DISEASES OF POULTRY.[1]

BERNARD A. GALLAGHER,
Bacteriologist, Pathological Division, Bureau of Animal Industry.

CONTENTS.

	Page.
Susceptibility to disease	1
How to prevent disease	2
How to control disease	2
Disinfectants and their application	2
Simple catarrh (colds)	3
Contagious catarrh (roup)	3
Chicken pox (diphtheria)	5
White diarrhea of chicks	9
Bacterium pullorum infection of fowls and chicks	10
Coccidiosis	12
Aspergillosis (brooder pneumonia)	13
Cholera	14
Choleralike diseases	15
Fowl typhoid	16
Tuberculosis	16
Enterohepatitis (blackhead)	18
Gout	20
Tumors	21
Rose-chafer poisoning	21
Leg weakness	22
Lameness in geese and ducks	22
Wing lameness in pigeons	23
Bumblefoot	23
Egg-bound	23
Vent gleet	24
Feather pulling	24
Toe pecking	25
Impacted crop (crop-bound)	25
Inflammation of the stomach or intestines	25
Limberneck	26
Diarrhea	26
Favus (white comb)	26
Gapes	27
Intestinal worms	30
Roundworms	31
Tapeworms	32
Lice	34
Mites	35
Common red mite	35
Depluming scabies	36
Scaly leg	36
Other mites	38
Chiggers or harvest mites	38
Ticks	38
Fleas	39

SUSCEPTIBILITY TO DISEASE.

DOMESTIC BIRDS are subject to a considerable number of diseases, some of which spread rapidly through the flock and cause a high mortality. They may also be infested by various kinds of parasites, some of which live on the surface of the body and others in the crop, stomach, or intestines. These parasites are injurious because they take a part of the nourishment which should be used by the bird to put on flesh or to produce eggs, and also because by their movements and their biting they cause irritation and inflammation of the parts which they attack.

The contagious diseases which are caused by germs and the weakness and loss of flesh caused by the larger parasites, to which reference has just been made, are the most important conditions which the poultryman has to consider in the endeavor to keep his birds healthy. These germs and parasites should be kept out of the flock by suitable preventive measures, because disease may be avoided much more easily and cheaply than it can be cured. The aim in studying the diseases of poultry is, therefore, to learn how to prevent the diseases as well as how to cure them.

[1] This bulletin supersedes Farmers' Bulletin 957, Important Poultry Diseases.

HOW TO PREVENT DISEASE.

Precautionary methods will do much to keep birds free from disease, since infections gain entrance to the flock through the introduction of new birds from infected flocks, exposure at poultry shows, or contact with fowls which are diseased. Infection may also be carried to premises on the shoes of man or feet of animals. Free-flying birds are apparently responsible for the spread of disease in some cases. Poultry keepers should quarantine newly procured fowls or show birds for two to four weeks, in order to allow symptoms of any disease which may be carried to develop.

The greater the number of birds kept upon any farm or plot of ground and the more they are crowded together the greater is the danger from contagion and parasites and the more important are the measures of prevention and eradication.

HOW TO CONTROL DISEASE.

As a rule, when a bird becomes sick the best policy is to kill it, for the reason that it may be affected by a contagious disease which, before it is recognized, may spread to many others in the flock. Also, if the poultry owner attempts to treat such birds, there is great danger of carrying infection from the sick to the healthy in handling or feeding. If a disease becomes established in the flock, however, a line of treatment should be undertaken when possible. In some diseases, such as cholera and the choleralike diseases, fowl typhoid, tuberculosis, and aspergillosis, treatment of affected birds is of little value and preventive sanitary measures must be depended on to keep infection as low as possible.

In controlling outbreaks of infectious diseases the first effort should be to separate the sick from the healthy birds as soon as symptoms become noticeable. The droppings should be removed from the houses daily and placed where the fowls will not have access to them. The houses and all feeding and drinking utensils should be frequently cleaned and disinfected. The use of permanganate of potash in the drinking water serves to prevent the spread of infection by means of the water, which otherwise is likely to be contaminated by discharges from diseased birds. The proportion is one-third teaspoon of permanganate to the gallon of drinking water. It is also advisable to give the entire flock a dose of Epsom salt in the proportion of one-half teaspoon to the adult fowl. The salt may be mixed in a sufficient quantity of mash for one feeding.

DISINFECTANTS AND THEIR APPLICATION.

Good disinfectants destroy the germs of contagious diseases, the external parasites, such as lice and mites, and in some cases the eggs of parasitic worms. The disinfectants should be thoroughly applied to the interior of the houses, worked into all the cracks and crevices, spread over the ceiling and the floor, the roosts, dropping boards, and nest boxes. At the same time the feeding and drinking troughs should be disinfected by pouring boiling water into them and afterwards drying them in the sun. Disinfectants are most easily applied to the walls and ceilings with a spray pump or with a brush. As it

is difficult to keep them from coming into contact with the face and hands, the more harmless of these mixtures should generally be used. Ordinary limewash made from freshly slaked lime is excellent, and its properties are well known. In the case of an actual outbreak of virulent disease it is well to add to the limewash 6 ounces of crude carbolic acid to each gallon to increase its activity as a disinfectant.

The kerosene emulsion, which is frequently used to destroy mites, may readily be converted into a disinfectant. To make the emulsion, shave half a pound of hard laundry soap into half a gallon of soft water and boil the mixture until all the soap is dissolved, then remove it to a safe distance from the fire and stir into it at once, while still hot, 2 gallons of kerosene. This makes a thick, creamy emulsion or stock mixture. When it is to be used for killing mites in the houses, 1 quart of this emulsion is mixed with 10 quarts of water. When it is to be used as a disinfectant, stir well, then add 1 pint of crude carbolic acid or crude cresol, and again stir until all is well mixed.

The compound solution of cresol is one of the best disinfectants and may be purchased ready for use. It contains 50 per cent of cresol, and 1 pint of it added to 10 quarts of soft water makes a solution of the proper strength to apply to the houses or to spray over the ground. A 5 per cent solution of carbolic acid (1 pint of carbolic acid to 10 quarts of water) is about equally efficacious. The choice between the two is a matter of convenience.

SIMPLE CATARRH (COLDS).

Simple catarrh is a mild inflammation of the nasal passages, and is common to all kinds of domesticated birds.

Cause.—No definite cause may be assigned to this affection. It has been asserted that weak or improperly nourished birds are more likely to be attacked than strong, vigorous, well-nourished individuals. Exposure to unfavorable conditions, in which rain, dampness, and cold drafts tend to lessen the resistance of the mucous membranes of the nostrils to the various organisms normally present in this region, has been held to be the primary contributing cause.

Symptoms.—The affected bird is more or less dull in appearance, according to the severity of the attack. The appetite is diminished, breathing becomes difficult, and a watery discharge from one or both nostrils is early in evidence. This discharge may disappear in two to four days, or it may take on a viscid consistency, closing the nasal openings and necessitating breathing through the mouth.

Treatment.—As the disease is of short duration, it is usually necessary only to place the patient under more favorable conditions to bring about recovery. In the more severe cases the nostrils should be washed out twice daily with boric acid in 3 per cent solution, or permanganate of potash, 1 dram (about a teaspoonful) to a pint of water.

CONTAGIOUS CATARRH (ROUP).

Contagious catarrh, or roup, attacks principally the membranes lining the eye, the sacs below the eye (infraorbital sinuses), the nostrils, and the windpipe (Fig. 1).

Cause.—The nature of the microbe which constitutes the virus of roup is not known. The contagion is generally brought into the poultry yard by infected birds. Sometimes they are birds which are purchased from other flocks in which the disease exists; sometimes they are birds of the home flock which have been in exhibitions and there exposed to sick fowls; and sometimes they are wild birds or pigeons which fly from one poultry yard to another.

The saliva and the discharge which escapes from the nostrils carry the contagion and soon contaminate the drinking water and feeding troughs, so that all the fowls are exposed to infection. Even the flocks in adjoining yards are infected by the particles of mucus projected into the air when sneezing, or by the contagion carried on

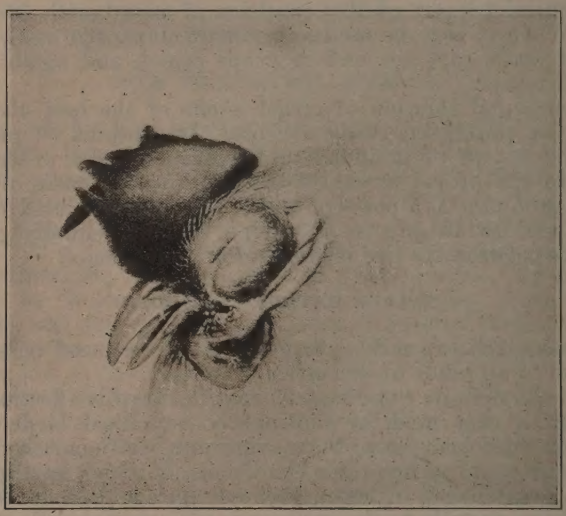

FIG. 1.—Head of fowl affected with contagious catarrh (roup), showing swelling of the eye.

the feet of persons, animals, or small birds that pass from one yard to another. Exposure to cold, dampness, and drafts aids in the development of roup.

Symptoms.—The symptoms first seen are very similar to those of an ordinary cold, but there is more fever, dullness, and prostration. The discharge from the nasal openings is at first thin and watery, but in two or three days it becomes thick and has an offensive odor. The inflammation, which begins in the nasal passages, soon extends to the eyes and to the spaces immediately below the eyeballs, causing the formation of swellings which may reach the size of a hickory nut. The eyelids are swollen, held closed much of the time, and may be glued together by the accumulated secretion. The closing of the eyes prevents the badly affected birds from finding food. The accumulation of mucus in the nostrils completely obstructs these passages so that the beak must be kept open to permit the bird to breathe. The obstruction of the windpipe and of the smaller air

tubes causes loud breathing sounds and difficult respiration. In the severe and advanced cases the birds sit in a somnolent or semiconscious condition, unable to see or to eat; their strength is rapidly exhausted, and many of them die within a week or 10 days. Some of the affected individuals recover, but others remain weak and have a chronic form of the disease for months, during which time they continue to disseminate the contagion.

This disease is distinguished from diphtheria (chicken pox) by the absence of the thick, tough, and very adherent cheesy exudates in the mouth and throat which are characteristic of the latter disease. Sometimes there may be a deposit of yellowish material on the walls of the mouth and throat, but it is easily broken up and removed. There are no warts on the comb, face, or wattles.

Treatment.—Medical treatment may be very successful if properly applied. The sick birds should be removed from the flock and put in a warm, dry, well-ventilated room which is free from drafts. The affected mucous membranes of the nostrils and mouth should then be treated by applying antiseptic solutions. The best method is to use a good spraying apparatus, but, lacking this, a small syringe, an oil can, or even a medicine dropper can be made to answer the purpose, or the bird's head may be plunged into a basin or bowl of the solution and held there a few seconds, but not long enough to cause suffocation.

The antiseptics most suitable for such treatment are: Boric acid 1 ounce, water 1 quart; or permanganate of potash 1 dram, water 1 pint; or peroxid of hydrogen 1 ounce, water 3 ounces. Where the inflammation has progressed to the eye, excellent results have followed the use of argyrol. One or two drops of a 15 per cent solution are introduced between the eyelids twice daily for a period of several days.

Before applying these substances it is well to wash the eyes and mouth with warm water containing 1 teaspoon of common salt to a quart, using a pledget of absorbent cotton and rubbing gently, while at the same time pressing and massaging about the nostrils and under the eyes to loosen the accumulated secretion. If there is a swelling under the eye, it should be carefully opened with a sharp, clean knife, all the secretion removed, and the cavity washed with one of the above-mentioned solutions. A pledget of cotton moistened with the solution may be left in the opening for an hour or two.

The houses should be kept clean and dry and occasionally disinfected. Also dissolve one-third teaspoon of permanganate of potash in each gallon of drinking water. If the disease proves to be of a severe type, it is often better to kill the affected birds. This radical method avoids the retention of birds which may harbor the contagion and cause the development of subsequent outbreaks.

CHICKEN POX (DIPHTHERIA).

Chicken pox and diphtheria were originally thought to be separate diseases. It was discovered later that the virus which causes the formation of warts or pox nodules on the head, typical of chicken pox, also causes the cheesy patches in the mouth and eyes which are characteristic of diphtheria. Since the symptoms of chicken pox

and diphtheria are but external and internal manifestations, respectively, of the same disease, the two conditions are now combined and described as chicken pox. Chickens and pigeons are most frequently affected, but turkeys and birds generally are susceptible.

Cause.—Chicken pox is caused by a virus which passes through laboratory filters and can not be seen under the microscope. The disease is strictly infectious and never develops as a result of exposure to dampness and drafts alone, although these conditions favor its spread and tend to increase its malignancy. The contagion is in-

FIG. 2.—Chicken-pox nodules on comb, on wattles, and near corner of mouth. (After Hutÿra and Marek.)

troduced and disseminated in a flock in the same manner as described for roup. It is quite probable that biting insects, such as mites, also spread infection through inoculation from sick to healthy birds.

Symptoms.—The disease has the general symptoms of roup but is distinguished from the latter by an eruption of pox nodules on the head and by the presence in the mouth, throat, and eyes of tough, cheesy patches which are firmly attached to the tissues beneath them. (Figs. 2 and 3.)

The eruption appears as round, oblong, or irregularly shaped nodules from the size of a pinhead to that of a pea or a hazelnut. It is seen especially about the beak and nostrils and on the comb, the eyelids, the wattles, and the ear lobes. In some individuals, and

particularly in pigeons, the eruption is more generalized and is found on the skin of other parts of the body, as the neck, under the wings, on the rump, and about the vent. Here the nodules may become larger than on the head. The nodules begin as small red or reddish-gray growths with a shiny surface and gradually enlarge, while the color changes to a yellowish, brownish, or dark brown, and the surface dries and becomes shriveled, uneven, and warty in appearance. Owing to the number of nodules and the extension of the inflammation, large patches of skin become thickened and covered with hard,

FIG. 3.—Fowl diphtheria. Neck slit open to show diphtheritic patches in mouth and esophagus. (After Rätz.)

dry crusts, closing the nasal openings or the eyelids, and making it difficult even to open the beak.

The severity of the disease depends a good deal upon the extent of the internal diphtheritic deposits. These are at first thin, yellowish, or whitish in color, and gradually become thicker, firmer, and more adherent, so that considerable force is required to remove them. The mucous membrane beneath the deposit, when the latter is removed, is found to be inflamed, ulcerated, and bleeding, but it is soon covered by a new deposit. This exudate is called a false membrane, and when it is situated where the breathed air passes over it, it dries, becomes uneven and fissured, and its color changes to a dark brown. With pigeons the exudate is more friable and easily removed, and the mucous membrane beneath it is reddened but not ulcerated.

While the false membranes over the parts first affected are becoming thicker, the inflammation extends to the adjoining surfaces, and new diphtheritic centers develop, uniting with one another until the cheeks, tongue, palate, throat, and inside of the nostrils are covered. Very often the inflammation extends from the nostrils to the eyes, and sometimes it penetrates the air tubes to the lungs, or the gullet to the crop. When false membranes form in the gullet, crop, and intestines there is a rapid aggravation of the symptoms, an intense diarrhea, and the escape of blood with the droppings. This type of the disease is more frequent in waterfowl than in other birds. Some fowls in a flock are resistant, and after a few days of illness rapidly recover. Others remain dull, weak, and thin in flesh, and may have more or less catarrh and difficulty of breathing for a long time.

The period between exposure to the contagion and the appearance of the first symptoms varies from 3 to 15 days. The duration of the disease varies from two or three days to as many weeks in the acute cases, while the chronic form may continue for several months.

Treatment.—The treatment of fowls severely affected with diphtheria requires much time and patience, and as a rule does not pay. It is often better to kill the birds, bury or burn their carcasses, disinfect the poultry houses, and in that way eradicate the contagion as soon as possible.

If it is decided to treat the sick birds they should be removed from the flock and put into a comfortable, well-ventilated room that may be easily disinfected. Make a solution by dissolving 2 drams of common salt in a quart of warm water, and with a soft brush or a pledget of absorbent cotton dipped in this solution gently brush or rub the false membranes until they are disintegrated and loosened from the underlying tissues. Sometimes it is necessary to scrape them off with a spoon or knife, but it must be done carefully, so that bleeding will not be caused or the sensitive tissues injured. After the false membranes are removed, wet a pledget of absorbent cotton in tincture of iodin or in a 5 per cent solution of carbolic acid and apply it for a minute or two to the diseased surface. Another solution which may be used is made by dissolving 1 dram of permanganate of potash in a pint of water. A very good solution consists of 1½ ounces of boric acid and 1 ounce of powdered borax (borate of soda) dissolved in 1 quart of water and applied warm. The two last-mentioned solutions may be used to wash the eyes or may be injected into the nostrils. Argyrol may also be used as recommended in contagious catarrh. If large swellings appear beneath the eyes they should be opened with a clean, sharp knife, the contents of the cavity removed, and the space frequently washed with the boric-acid-borax or permanganate solution mentioned above.

The external lesions of this disease may be treated successfully by simple local applications. The crusts on the nodules are softened with carbolated ointment, glycerin, or oil, and after an hour or two removed by washing with warm water containing a little soap. The denuded tissue is then treated with a 5 per cent solution of carbolic acid or with tincture of iodin.

As this disease is contagious, the houses, drinking vessels, and feed troughs should be kept disinfected during the outbreak and for sev-

eral days after all the birds have apparently recovered. The drinking water is made antiseptic by dissolving one-third teaspoon of permanganate of potash in each gallon.

Chicken-pox vaccine is used for the prevention of the disease. Its results are variable. In some cases it appears to prevent or lessen the severity of outbreaks, while in others no benefit seems to be derived from its use.

WHITE DIARRHEA OF CHICKS.

White diarrhea is a commonly used term which covers the various diseases of chicks from the time of hatching until the birds are approximately one month old. It merely indicates a common symptom, a whitish diarrhea, which is usually observed in sick chicks, no matter what the specific nature of the disease may be.

Cause.—There are four important infectious diseases of fowls which affect baby chicks and induce a whitish diarrhea. These are *Bacterium pullorum* infection, coccidiosis, aspergillosis or brooder pneumonia, and cholera. It is necessary that these diseases be treated separately, as their causes, modes of infection, treatment, and the methods for their control differ. They are described under the foregoing names elsewhere in this bulletin. Other conditions, such as faulty regulation of brooder heat and feeding, may cause symptoms of white diarrhea.

Symptoms.—The symptoms in the different forms of white diarrhea of chicks are quite similar and will be given here in order to make unnecessary their repetition under each of the diseases referred to above.

The form of white diarrhea caused by *Bacterium pullorum* infection is observed in chicks from the time of hatching until they are three weeks old. The other three forms of the disease may occur during the first three weeks or later. The chicks may die suddenly after having shown but slight symptoms for a short time. Generally, however, there is first observed a disposition to huddle together and to remain under the hover or under the hen more than young chicks should. Very soon they appear listless, stupid, sleepy, and indifferent to what is going on about them. They stand in one position or sit still with the eyes closed, and the few efforts which they make to pick up feed appear mechanical and unsuccessful. Their plumage loses its luster, the wings droop or project slightly from the body, and the characteristic diarrhea soon appears. The droppings may be white and creamy, mucilaginous and glairy, or they may be mixed with a brownish material. In acute coccidial white diarrhea the droppings are frequently bloody. Often the sticky excrement adheres to the down about the vent, dries, and continues to accumulate until it completely covers and plugs the opening. This condition, known as "pasting up behind," unless soon relieved will bring about the early death of the chick. Many of the diseased chicks chirp or peep almost constantly, and when attempting to void the excrement they may give utterance to a shrill cry, as if the effort brought on paroxysms of pain. As death approaches, the breathing becomes labored and the abdomen heaves with each breath. Toward the last the strength is completely exhausted and the chick sits constantly or lies on the side with out-

stretched wings until it dies (Fig. 4). The most prominent and characteristic symptoms in nearly all cases are the white, diarrheal discharges and the rapid wasting away of the affected birds. When infection is present, the losses vary from 50 to 80 per cent of the chicks hatched. Sometimes it is impossible to raise any of them.

Post-mortem appearance.—Post-mortem examination reveals an unabsorbed yolk in the majority of cases. In white diarrhea caused by *Bacterium pullorum* the liver may have an ocher color and areas of congestion. The lungs may show small necrotic spots. In coccidial white diarrhea the ceca or blind pouches of the intestine are usually distended with necrotic or bloody material. In aspergillar white diarrhea the lungs and air sacs are the seat of moldy growths.

Treatment.—Medical treatment of affected chicks is impracticable, except in the coccidial form, as it has very little effect on the course of the disease. The birds may be given sour milk or buttermilk to drink. One-third teaspoon of crude catechu added to a gallon of

FIG. 4.—Chicks affected with white diarrhea.

drinking water is very effective in the coccidial form of white diarrhea.

For further information on the above-mentioned forms of white diarrhea the reader is referred to the portions of this bulletin dealing with *Bacterium pullorum* infection, coccidiosis, brooder pneumonia, and cholera.

BACTERIUM PULLORUM INFECTION OF FOWLS AND CHICKS.

The microorganism known as *Bacterium pullorum* causes a disease in hens which is generally confined to the ovary. This infection is widespread in the United States and is responsible for enormous losses through its spread by means of the egg to baby chicks, causing "white diarrhea."

Cause.—Chicks which recover from bacillary white diarrhea frequently retain the causative organism, *Bacterium pullorum*, in their bodies, where it later localizes in the active ovary. The disease may be contracted also by feeding with fowls that harbor the organism or by eating infected eggs. In some cases from 50 to 70 per cent of a

flock of hens may be affected. Many of the eggs laid by these hens carry the microorganism, and chicks hatched from them spread the disease to others of the brood. Chicks are highly susceptible to infection during the first 48 hours of life, but are practically insusceptible after the third day. Nearly all the exposed chicks become infected, and the death rate may reach 100 per cent.

Another source of infection is through incubators and brooders which have previously held diseased chicks. Day-old chicks from infected flocks may carry infection to other points and contaminate brooders or infect other flocks.

Symptoms.—In acute outbreaks or in experimental infection the hen becomes droopy, the feathers ruffed, the comb and wattles pale, and the head drawn back. There is loss of appetite, and diarrhea is

FIG. 5.—Normal ovary of fowl (left) and ovary affected with *Bacterium pullorum* (right). (After Rettger.)

often in evidence. Death follows in from one to several days. In the ordinary form of the disease, however, no external symptoms are observed, and it is only through the presence of white diarrhea in the chicks or the detection of diseased ovaries in slaughtered hens that attention is directed to the presence of the disease in a flock.

In baby chicks infected in the egg, symptoms appear immediately after hatching or in a day or so. Chicks which contract the disease after hatching show symptoms in from 4 to 10 days later. Deaths occur from the time of hatching until about three weeks later, when the brood is practically wiped out. For symptoms in chicks see White diarrhea, page 9.

Post-mortem appearance.—The ovary presents a characteristic appearance. The partially or wholly developed yolks are angular in outline, shrunken, hard, and discolored to a dark-brown or greenish color (Fig. 5). At times yolks containing dark fluid are present.

The presence of the disease in a flock may be detected by post-mortem examination, by laboratory methods, or by other special tests.

Prevention.—The nature of the affection renders treatment futile. Flocks which harbor the infection should not be used for breeding purposes. The cycle of infection established by the hen, the egg, the recovered baby chick, and the pullet indicates that it is not advisable to save for breeders any chicks which have been exposed to an outbreak of white diarrhea. Where the value of the breed makes its perpetuation desirable, careful incubation may result in the raising of a clean brood of chicks from an infected flock. The trays of the incubator are divided, one or two days before hatching time, into compartments large enough for from 5 to 10 chicks, as the owner may decide. These trays are so constructed as to prevent the exposure of chicks in one compartment to those in another. The birds should be kept isolated in this manner for at least three days or transferred to a brooder provided with similar arrangements for segregation. Should disease break out the chicks in the particular compartment are to be removed and disposed of. The attendant should carefully disinfect the compartment and his hands before caring for the others. After a few days the danger from infection is very slight and all the brood may be allowed to run together.

COCCIDIOSIS.

Coccidiosis is a disease of the intestine and affects all domestic birds. It is especially destructive to chicks up to 2 months old and represents one of the conditions known as "white diarrhea" in baby chicks.

Cause.—A protozoan organism of microscopic size known as *Eimeria* (*Coccidium*) *avium* causes the disease. The transmission of infection from diseased to healthy birds occurs by contamination of the feed, water, and ground. The coccidia multiply with great rapidity in the intestines of diseased birds, and enormous numbers are discharged with the droppings.

Symptoms.—Baby chicks and those under 2 months old show the symptoms described under "White diarrhea" (p. 9). The disease runs a rapid course, and the losses may reach 75 per cent of the brood.

Adult fowls have considerable powers of resistance to this parasite, and the disease with them is more frequently seen in a chronic form. The symptoms are dullness, weakness, sleepiness, diarrhea, and loss of weight, although the birds retain their appetites for a considerable time. In many cases the only symptoms are diarrhea with loss of weight and after a time apparent recovery, though the organisms continue to multiply in the intestine and to be spread with the droppings for several months afterwards. Fowls affected in this manner may die suddenly without previously showing any serious symptoms. Young chicks frequently void bloody droppings, and the bowel contents are bloody.

Pigeons are affected with a more acute type of this disease in which the symptoms appear only a short time before death. Generally, however, they are dull and sleepy for a day or two, and sometimes they have a chronic form, characterized by diarrhea and loss of weight.

Geese with coccidiosis of the kidneys lose flesh rapidly without apparent cause and become very weak and almost unable to walk. They remain quiet most of the time, with the belly resting upon the ground. Some of them lie on their backs with their feet widely separated; and if placed upon their feet, take a few steps, fall, and resume their former position. In all such cases the birds lose their appetites and become progressively weaker until they die.

Treatment.—Put one-third teaspoon of crude catechu in each gallon of the water given the birds to drink. Permanganate of potash, one-third teaspoon to the gallon of drinking water, is quite effective as a substitute. Also feed sour milk or buttermilk. Treatment should be continued until signs of disease disappear from the flock.

Prevention.—As the coccidia are brought on to the premises with birds or with eggs for hatching obtained from infected birds, or by pigeons flying from place to place, the necessary precautions should be observed to guard against such channels of infection. Fowls and eggs should be obtained only from flocks known to be healthy, and pigeons should be excluded from the poultry yard.

This form of contagion is very difficult to destroy, and the most active disinfectants should be used in the houses and yards. A mixture containing 5 per cent of compound solution of cresol is not too strong. The bodies of the birds which die should be burned.

ASPERGILLOSIS (BROODER PNEUMONIA).

Aspergillosis is a fungus disease of the lungs and air sacs which may affect any of the domestic birds. It often causes heavy losses in baby chicks and is then known as brooder pneumonia.

Cause.—The causative agent is the common green mold, *Aspergillus fumigatus*, which grows on vegetables and other kinds of matter. Warmth and moisture favor its development. When moldy hay, straw, or chaff is given to the fowls to scratch in, or moldy grain is fed, the spores of the fungus are inhaled by the birds. The filaments of the mold are capable of passing through the eggshells and it is believed that some outbreaks in brooder chicks may be due to infected eggs which have been exposed to moldy material.

Symptoms.—This disease may be limited to a single bird or it may affect a large number, as in brooder pneumonia. When the air tubes or lungs are attacked, the first symptom is a slight catarrh, with accelerated breathing. Soon the swellings obstruct the passage of air and there is a rattling or croupy sound, heard chiefly during expiration. The affected birds mope, separate themselves from the remainder of the flock, or remain in a sitting posture; if made to move it is seen that they are weak and scarcely able to walk, and if they try to run they soon fall from exhaustion. The difficulty of breathing increases rapidly; they gasp for breath and make movements of the head and neck as if choking; there is fever, diarrhea, drooping wings, great depression, a tendency to sleep, and finally suffocation and death.

When the disease is limited to the large air sacs the only symptoms are weakness and progressive loss of flesh. If the small air sacs of the bones are involved there may be lameness, with swollen and inflamed joints. The symptoms in brooder chicks are similar to

those of white diarrhea (page 9). The disease is always fatal. Young chicks die within a few days. Older birds may live one to four or more weeks after the appearance of symptoms.

Post-mortem appearance.—The walls of the windpipe, air passages in the lungs, and air sacs in the abdominal cavity show whitish or yellowish nodules in the early stages of the disease. Later the walls are covered by elevated dirty-yellow or greenish layers, which represent growths of the mold.

Prevention.—The disease is prevented by giving only clean and bright straw or chaff for the fowls and brooder chicks to scratch in, by keeping the houses and yards clean, and using for feed grain and meal which are sound and entirely free from mold. The sick birds should be removed from the flock and the bodies of those which die should be burned or buried.

CHOLERA.

Cholera is a highly infectious, rapidly fatal disease of all domesticated birds. Birds of any age are susceptible.

Cause.—It is caused by *Pasteurella choleræ gallinarum*, a germ which multiplies to enormous numbers in the blood and various organs of the body, producing a septicemia or blood poisoning. The disease is carried by sick or recently recovered birds which have been placed in a healthy flock, by wild birds, or by persons, animals, or poultry utensils which have been on infected premises. It spreads rapidly throughout the flock, owing to the fact that the first birds to become infected give off great numbers of the germs in their droppings and these germs are picked up by the other birds in feeding and drinking.

Symptoms.—The first symptom is a yellowish coloration of the droppings. This is followed by a yellowish, brownish, or greenish diarrhea. The bird becomes droopy, feverish, and sleepy, and sits with the head drawn down to the body or turned backward and resting in the feathers about the wing. Appetite diminishes and thirst increases. Breathing becomes difficult and may be heard at some distance. Finally the weakness is such that the bird can not stand, but lies with the beak resting on the ground. It sleeps so soundly for some time before death that it can hardly be aroused. The comb and wattles may be a dark bluish red and the skin of the breast and abdomen is frequently reddened.

In very acute cases no symptoms are seen; the birds may be found dead under the roosts or they may fall while feeding or moving about and die in a short time. During an acute outbreak sickness is seldom noticed more than 24 hours before death, which usually occurs within three days from the time of infection.

Cholera may destroy the greater part of a flock in a week and then disappear, or it may linger in a chronic form for months, only occasionally killing a bird. The chronic form is characterized by a continually increasing weakness, loss of weight, paleness of head, and finally an exhausting diarrhea. Sometimes one or more joints of the wings or legs swell, the bird becomes lame, and later the swellings break and discharge a creamy or cheesy mass.

Post-mortem appearance.—The heart has red spots or hemorrhages on its surface. The first portion of the intestines is congested and

hemorrhagic, and the contents consist of a pasty mass, which may be bloodstained. The blood vessels of the visceral organs are congested. The liver may be enlarged and darker in color and the spleen may be swollen. A sticky fluid is frequently present in the mouth and nostrils.

Treatment.—Since treatment of affected birds is futile, the aim should be to prevent so far as possible the spread of infection. The first fowls showing acute feverish symptoms should be destroyed by a method which would guard against the contamination of the premises by infected blood. The carcasses should be burned or buried deep. The healthy fowls should be moved to new quarters if possible and carefully watched for signs of disease. Houses and runs should be thoroughly cleaned at frequent intervals and disinfected with carbolic acid in 5 per cent solution, compound cresol in 2 per cent solution, or a reliable coal-tar disinfectant in proper dilution. The drinking water may be made antiseptic by adding one-third teaspoon of permanganate of potash to each gallon, a procedure which serves to prevent the spread of disease through the water and also is a convenient means of administering an internal antiseptic.

CHOLERALIKE DISEASES.

There are several diseases similar to cholera which have been investigated and described as different because the bacteria which cause them differ in some of their characteristics. The symptoms and the changes which are seen after death are so nearly identical that it is only by studying the bacteria that any one of these diseases can be distinguished from the others. For the practical purpose of combating them in the poultry yard we may therefore group these diseases together.

Cause.—Certain germs (bacteria), like *Bacterium coli*, which are nearly always found in the intestines of healthy birds, have more or less power to produce disease, but the sound, healthy bird is able to resist them under favorable conditions. When the resisting powers of fowls are diminished by exposure to cold, hunger, thirst, and exhaustion, as occurs during long shipments by rail, these germs may cause diseases. In some countries the sickness which develops from these conditions is called "the transportation disease."

It happens sometimes that these diseases develop in insanitary poultry yards, possibly because of the large numbers of germs taken into the bodies of the birds. When the germs begin growing in the tissues of fowls they soon increase their virulence, and the disease which they cause may rapidly spread from fowl to fowl until most of the birds are dead.

The choleralike diseases, therefore, may either develop in the poultry yard from insanitary conditions, or be introduced by contagion carried by new birds which are added to the flock, by birds which have been in exhibitions, by wild birds which fly from one poultry yard to another, or by various animals, such as dogs, cats, and rats. Birds which recover from a disease may sometimes carry the germs and disseminate the contagion for six months or a year after they are apparently well.

Symptoms.—The manifestations of these diseases are much like those of cholera and for practical purposes need not be described separately. The choleralike diseases are differentiated from true cholera by their slower spread and lessened mortality.

Treatment.—Treatment and prevention follow the same lines advised for cholera.

FOWL TYPHOID.

Fowl typhoid is an infectious disease of mature chickens which has not been observed in other domestic birds. It attacks the blood and internal organs.

Cause.—The disease is caused by *Bacterium gallinarum*, a microorganism which is introduced on the premises through the agency of carriers, such as infected fowls, material from infected poultry yards, by free-flying birds, or on the feet of persons or animals which have been on infected premises. Typhoid spreads through a flock in a manner similar to cholera and most of the infectious diseases, but is not so destructive as acute cholera.

Symptoms.—These are drowsiness, fever, loss of appetite, and general weakness. The droppings are soft and yellowish or greenish. The membranes of the head, comb, and wattles are usually paler than normal, but in acute cases may be darkened with venous congestion. Complete prostration may develop in from several hours to one or two days before death. Symptoms become noticeable in from 4 to 6 days after infection takes place and last in fatal cases from 4 to 12 days.

Post-mortem appearance.—The internal parts of the body other than the liver and the spleen have a pale appearance. The mucous membrane or interior wall of the intestine is usually pale. The blood is thin, pale red in color, and does not clot readily. The liver is greatly enlarged and generally dotted with grayish spots. It has a tendency to break easily. The spleen is often swollen, pulpy, and filled with grayish spots. The kidneys are somewhat enlarged and lighter in color or slightly injected with blood. The heart appears normal or else pale, with grayish spots on its surface.

Treatment.—The treatment advised for cholera applies also to fowl typhoid, since sanitary measures must be depended on for its control.

TUBERCULOSIS.

Tuberculosis is a chronic infectious disease of domestic and wild birds. It is most common, however, in the fowl and pigeon. It is readily contracted by pigs, rats, and mice, but man is rarely affected by avian tuberculosis. Parrots and canaries are quite susceptible to human tuberculosis, while fowls are practically insusceptible.

Cause.—The disease is caused by *Mycobacterium tuberculosis avium*. Tuberculosis is generally brought into the poultry yard with fowls that are purchased from infected flocks or with the eggs of diseased birds that are obtained for hatching. If the disease exists in neighboring flocks the contagion may be carried by small birds or animals passing from one yard to another. A peculiarity of tuberculosis of birds is that the liver and intestines are nearly always very severely affected, and that as a consequence the organisms are very

numerous in the intestinal contents and are scattered with the droppings everywhere that the fowls go. The introduction of a single diseased bird, therefore, may cause the infection of the greater part of the flock in a few weeks. In the same way, when wild birds contract the disease, the germs are carried and deposited in all the yards which they visit.

The eggs of diseased birds frequently contain the microbes, and the young chicks hatched from such infected eggs are diseased when they leave the shell and soon infect the poultry with which they run. Moreover, since the infertile incubated eggs are often fed to chickens, it is clear that even the eggs which do not hatch may introduce the contagion unless they are cooked before feeding.

Pigs, rats, and mice are especially liable to be infected with fowl tuberculosis from eating the carcasses of birds which have died, and these animals serve to keep up the contagion and may communicate it to other fowls, especially if the latter eat the carcasses of rats or mice that died of the disease.

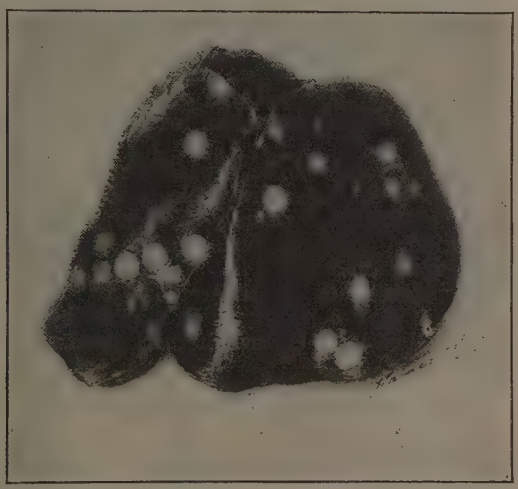

FIG. 6.—Liver of pheasant, showing lesions of tuberculosis.

Symptoms.—Although birds may become infected at any age, the disease usually progresses slowly and symptoms are generally not observed until the affection has reached an advanced stage. Hence it is the older fowls, those more than 1 year of age, which display the most pronounced symptoms and show a high death rate.

Signs of disease begin with gradual loss of weight, wasting of the muscles, especially noticeable in the breast, paleness of the comb, and, toward the end, dullness, sleepiness, and diarrhea with yellowish or greenish droppings. Very often there is at the same time a tuberculous inflammation of the joints and of the sheaths of tendons, which is revealed by lameness and swelling of the joints and legs. Occasionally the skin over the swollen joint breaks, the interior of the joint is ulcerated, and a small quantity of cheesy material is discharged. Deaths in the flock occur at intervals. Affected birds

may live only a short time after symptoms are noticed, or they may live for weeks.

Post-mortem appearance.—On post-mortem examination grayish-white or yellowish colored tumors of varying sizes are observed in the internal organs, but especially in the liver, spleen, and intestines. These tubercles when cut open present a solid, grayish, glistening interior which in the larger ones exhibits yellowish centers, or a number of yellowish points. Those of more advanced growth show extensive yellowish, cheesy, or crumbly masses in their interior (Fig. 6).

Treatment.—There is no treatment that will cure tuberculous birds. The most thorough method of eradication is to slaughter the entire flock when indications point to an extensive outbreak. Fowls in good flesh, showing no lesions or slight ones, may be used for food. Those badly diseased and all visceral organs of the others should be destroyed.

The chicken houses, inclosed runs, and all eating, drinking, and other utensils should be thoroughly cleaned and disinfected with a strong disinfectant solution. After disinfection the premises should be kept free of fowls for a year if possible, or new stock may be placed on ground which has not been occupied by poultry for a year or more. In restocking, obtain birds or eggs for hatching from flocks which have shown no signs of an infectious disease for a year or more.

When the breeding value of the fowls or other interests make it undesirable to dispose of the entire flock, tuberculosis may be controlled to a great extent by disposing of all birds at the end of the second laying period. Younger birds should be disposed of whenever they appear to be abnormal.

More detailed information on tuberculosis of fowls is given in Farmers' Bulletin 1200, a copy of which may be had on request to the Division of Publications, United States Department of Agriculture, Washington, D. C.

ENTEROHEPATITIS (BLACKHEAD).

Enterohepatitis or blackhead is a disease of the intestine and liver which is most frequent in and most injurious to turkeys, but which may also attack chickens. In the course of the disease the head often becomes dark colored or nearly black, and for that reason it is popularly known as blackhead, although it is only the internal organs that are directly affected by the disease. The disease is widely disseminated and in some localities has made the production of turkeys nearly impossible.

Cause.—The disease is caused by a parasitic protozoan microorganism, which leaves the body of the sick bird, or carrier, with the excrement and infects other birds by entering the digestive organs with the feed and drink. Fowls, while not readily infected, serve as carriers of the organism and spread the disease to poults.

Some investigators found that when infective blackhead material was fed to turkeys at the same time that eggs of the cecum worm, *Heterakis papillosa* (discussed on page 31), were fed to these birds the turkeys developed blackhead, whereas when the infective blackhead material was fed without these worm eggs the turkeys did not

readily develop blackhead. Other experiments have pointed to the Heterakis eggs as carriers of the blackhead organism. It appears from this that these worms may be of great importance in establishing infection with blackhead when the organism of the disease is present. For this reason, as well as for other reasons, it is advisable to use appropriate measures for the control of these worms.

Symptoms.—The symptoms of enterohepatitis are most frequently seen in young turkeys, commonly called "poults," which are from 2 weeks to 3 or 4 months old. In the more acute cases the poults usually die within a few days after symptoms appear. In less acute cases and in older turkeys the course of the disease is longer.

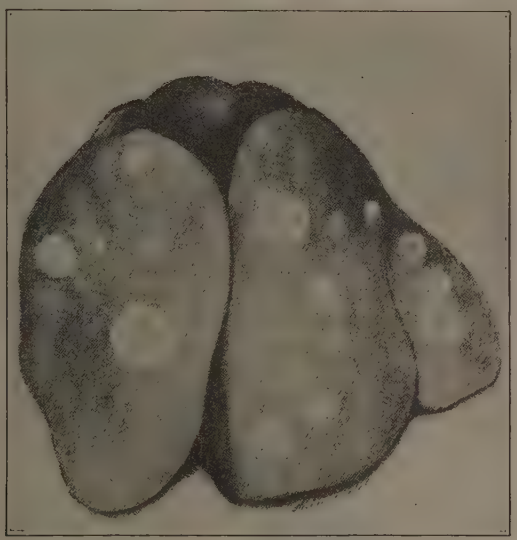

FIG. 7.—Enterohepatitis (blackhead). Liver of turkey, showing necrotic areas.

The affected birds at first appear less lively than usual, are not so active in searching for feed, and when fed show a diminished appetite. Diarrhea is a nearly constant symptom, naturally associated with the inflammation of the ceca or two blind pouches of the intestine. As the disease progresses there is dullness and weakness, the wings and tail droop, and there is often the peculiar discoloration of the head. There is increasing prostration and loss of weight; the affected birds, instead of following their companions, stand about in a listless manner, indisposed to move and paying little attention to what occurs about them.

Post-mortem appearance.—In nearly all cases of blackhead the liver is enlarged and covered with degenerated, yellowish or yellowish-green circular spots of varying size (Fig. 7). The ceca, or two intestinal pouches, are distended, their cavities being filled with a grayish friable or cheesy mass. This represents destroyed tissue resulting from the action of the blackhead organism on the intestinal wall.

Prevention.—Since treatment of diseased birds has not proved to be successful, the only hope of success at present against blackhead is in prevention. The measures of prevention which give the greatest promise are as follows:

(1) Obtaining eggs from birds believed to be healthy; (2) wiping the eggs with a cloth wet with denatured alcohol (80 to 90 per cent) before they are placed in the incubator or under the hen for hatching, to remove any contagion that might be on the shell; (3) hatching in an incubator, or at least removing the eggs from under the hen a day or two before hatching would occur, wiping with alcohol, and finishing in an incubator, in order to avoid exposing the poults to the hen; (4) placing the young poults in a brooder on inclosed ground at a distance from all other domesticated fowls and not recently occupied by other fowls; (5) excluding, so far as possible, pigeons, other wild birds, and rats and mice from the houses and runs occupied by the turkeys; (6) frequent disinfection of the houses, feeding troughs, drinking fountains, etc.; (7) immediate killing of diseased birds and the destruction of their bodies by fire. The turkeys should be confined in the inclosure until grown and given sour milk or buttermilk frequently.

GOUT.

Gout is marked by the presence of an abnormal quantity of uric acid in the blood, which results in the deposit of urates on the internal organs (visceral gout) or more frequently in the joints (articular gout).

Cause.—The increased quantity of uric acid may be induced by several causes. Prolonged feeding on substances rich in albumin, especially if associated with lack of exercise, is probably the most frequent predisposing factor. Diseases which affect the urinary organs, causing a failure to eliminate the uric acid properly, play an important part in the causation of gout.

FIG. 8.—Chicken affected with articular gout. (After Kionka.)

Symptoms.—The joints of the feet are most frequently and severely affected, although the wing joints may also be involved. At first the joints are swollen and painful. Later the lesions form into nodular, tumorlike growths which vary in size and may be either hard or fluctuating. (Fig. 8.) Frequently the swellings burst, discharging a yellowish, turbid material containing urates. The bird avoids walking as much as possible and remains in a sitting position. The general health becomes affected and emaciation gradually occurs, with weakness and frequently diarrhea. Visceral gout is apparent on autopsy only. The internal organs and serous membranes are found covered with chalklike deposits. The course of the disease is slow.

Treatment.—Artificial Karlsbad salt has been beneficial. This is prepared by mixing together sodium sulphate 22 grams, potassium sulphate 1 gram, sodium chlorid 9 grams, and sodium bicarbonate 18 grams. Six grams (or one-fifth of an ounce) of this mixture are added to 1 quart of drinking water. Tincture of colchicum in from 2 to 5 drop doses per bird may also be used. Enlarged joints may be opened and the contents washed out. When moderately severe symptoms are shown, it will be best to fatten and kill the bird before the onset of emaciation. When several fowls in the flock develop symptoms, the diet should be looked into and corrected if necessary. Often a reduction in the quantity of meat scrap and an increase in green feed will prevent additional cases. The entire flock should receive a dose of Epsom salt, one-third teaspoon to each adult bird.

TUMORS.

Tumors are of frequent occurrence in birds and present a number of varieties. The largest percentage is found in fowls more than 2 years old. In hens the egg organs are affected in more than 50 per cent of cases. Bird tumors have a marked tendency to break down and cause death from internal hemorrhage. Tumors on the skin are easily recognized, while internal ones may be suspected when an individual in the flock shows poor condition, increasing droopiness, or emaciation.

Treatment.—There is no treatment for internal tumors. External ones can be removed satisfactorily in some cases by an operation. Since many of the growths, however, are of a malignant or cancerous nature, it is best to dispose of the bird.

ROSE-CHAFER POISONING.

Rose chafers are extremely poisonous to chickens under 10 weeks old. When these beetles are on vegetation chickens devour them readily, and only a few are necessary to cause death.

Symptoms.—Signs of poisoning may appear as early as one hour after feeding on the chafers, and death may follow in one hour after the appearance of symptoms. If sufficient poison is not absorbed to cause death the bird recovers. The affected chicken becomes drowsy, shows weakness of the legs, and falls over on its side. There may be convulsions. Sharp cries are frequently emitted, and the head and neck are retracted over the back of the bird. The only internal sign is the presence of rose chafers in the crop.

Treatment.—The rapid action of the poison renders treatment futile in birds showing symptoms. When the nature of the trouble is realized, others of the flock which had opportunity to eat chafers should be given Epsom salt in the proportion of one-fourth teaspoon, mixed with a small amount of feed, to each bird. Preventive measures consist in keeping young chickens in inclosed runs or at points where they will not have access to grapevines, rosebushes, and shrubbery when the insects are prevalent. This corresponds somewhat closely to the time of first blossoming of the various garden flowers.

LEG WEAKNESS.

Leg weakness is a term commonly used to describe a condition of birds in which there is unsteadiness of gait or inability to stand. It is not a specific disease, but is a symptom associated with a number of diseases.

Cause.—Among the causes may be mentioned the various infectious diseases which produce extreme debility, such as cholera and the choleralike diseases, fowl typhoid, coccidiosis, enterohepatitis or blackhead of turkeys, and white diarrhea of chicks. Other causes are mineral and food poisons, including those of vegetable and animal origin, rickets from lack of lime salts in the feed, polyneuritis from lack of vitamins in the feed, close confinement of growing chicks, and paralysis.

Treatment.—An effort should be made to determine whether an infectious disease or poison is the cause and to treat accordingly. If deficiency in necessary mineral or other elements in the feed is the probable cause, a wide variety of feed with plenty of green feed should be given and the birds allowed ample room for exercise or turned out on free range. Ground oyster shells or calcium phosphate should be fed freely, and 1 dram of copperas may be added to each gallon of drinking water. Leg weakness in young chicks, when due to confinement with lack of sunlight, soil, and space for exercise, is corrected by giving cod-liver oil, 2 or 3 drops per bird, mixed in the feed daily.

LAMENESS IN GEESE AND DUCKS.

Geese and ducks are affected with an inflammatory condition of the joints of the feet and wings, associated with an internal infectious disease.

Cause.—The disease is caused by a microorganism known as *Staphylococcus pyogenes aureus*, which multiplies in the internal organs and the bones and joints.

Symptoms.—Principally young ducks and geese are affected. The disease may be acute, causing death in from two to four days, or chronic, with symptoms continuing for more than two weeks, when death may occur or gradual recovery take place. In acute cases there is general depression, diarrhea, and discharge from the eyes. In chronic cases the general symptoms are less marked but emaciation is pronounced. The characteristic symptoms in both cases are lameness and swelling of the joints of the legs or feet. Usually only one leg may show lameness, and the hock joint or one of the toe joints

is most often affected. The swellings are hot and painful. The bird frequently lies on its breast with legs extended backward and if forced can move only short distances by flapping the wings. Sometimes the wing joints are swollen and the wings droop.

Post-mortem appearance.—The intestine is inflamed and its contents are slimy and reddish in color. The liver and spleen are enlarged. The diseased joints are reddened, swollen with fluid, and contain yellowish, fibrous, or cheesy exudates.

Treatment.—Acute cases do not respond favorably to treatment. The joints should be painted daily with tincture of iodin. Separate the sick from the well and keep the houses and utensils clean and disinfected. Keep the ducks and geese from stagnant water and when giving drinking water dissolve one-third teaspoon of permanganate of potash in each gallon.

WING LAMENESS IN PIGEONS.

Pigeons have swollen and disabled wing joints as a result of tuberculosis, gout, or mechanical injuries. They also are affected with a disease seen on the head, neck, or wings which is caused by an infectious organism resembling somewhat the causative agent of tuberculosis. This germ grows underneath the skin and induces the formation of lumps of yellowish cheesy material which enlarge to the size of a marble. When these lumps are present in the wing, especially near a joint, flight may be impaired or rendered impossible.

Treatment.—Lance the skin over the growth, press out the ball of cheesy matter and paint the cavity with tincture of iodin daily for several days.

BUMBLEFOOT.

Bumblefoot is a term applied to a swelling of the foot and is most often seen in fowls. It may result from bruises, as in the case of heavy birds jumping from high perches to hard surfaces, or it may be due to cuts or punctures of the skin of the foot which becomes infected by germs. These organisms set up an inflammation and the formation of fluid or cheesy suppurative material usually in the ball of the foot.

Treatment.—In some cases the application of tincture of iodin to the swollen area daily for several days will bring about recovery. If the swelling is hot and has the appearance of an abscess it should be lanced and the contents washed out. The interior of the abscess is then soaked with 5 per cent carbolic acid or tincture of iodin and the foot bandaged. The fowl should be placed in a small compartment without a perch and the wound disinfected daily for several days.

EGG-BOUND.

The condition known as "egg-bound" (failure to pass the egg in the normal manner) is of frequent occurrence in fowls, especially in pullets when beginning to lay.

Cause.—The difficulty may be due to inflammation, stricture, or tumor formation in the posterior part of the egg passage. Some times malformed or double-yolked eggs are responsible. In pullets

the usual cause is an attempt to lay large-sized eggs before the egg passage has become sufficiently dilated to accommodate them.

Symptoms.—Affected hens become restless and make frequent visits to the nest in efforts to lay. The straining may cause inflammation and often eversion of the oviduct (egg tube) through the vent. Others of the flock, attracted by the inflamed, protruding parts, peck at them and tear out portions of the egg passage and intestine, causing the death of the hen. If prolapse does not occur the distressed fowl may continue her effort to lay until successful or until overcome by weakness or internal hemorrhage from rupture of the oviduct. The egg may be felt by passing the forefinger through the vent.

Treatment.—The surest method of treatment is to remove the egg by the following procedure: Pass the forefinger through the vent. With the other hand pressing on the abdomen of the fowl force the egg toward the vent, guiding it by the aid of the inserted finger. When the shell is observed through the vent puncture it with an awl or other sharp-pointed instrument, break it in pieces, and withdraw these and the egg contents. Isolate the bird and inject cold water into the cloaca (the common passage into which the intestine and the oviduct open) to reduce the inflammation. If the oviduct has been everted through the vent, clean and push the parts back and inject cold water frequently until the tissues remain in place.

VENT GLEET.

Vent gleet is an infectious venereal disease of fowls which is spread by the rooster in treading. Its causative agent is not known.

Symptoms.—There is inflammation of the cloaca and vent. The skin around the vent is swollen, reddened, and ulcerated, and an offensive odor is usually present. The droppings are foul smelling and liquid and are frequently voided. Other chickens may peck at the inflamed part and often tear the cloaca and rectum, causing death of the victim.

Treatment.—The disease is very resistant to treatment. It is usually better to destroy the bird. If treatment is desired, 5 per cent carbolic acid or 2 per cent carbolic ointment may be applied daily over the affected area. Argyrol in 20 per cent solution may be injected into the cloaca twice daily. Remove the roosters from the flock while the disease is present, and destroy any found affected.

FEATHER PULLING.

Feather pulling is a vice which may originate from several causes, such as close confinement with idleness, lack of sufficient mineral or animal matter in the feed, or the presence of itch mites at the base of the feathers (see "Depluming scabies," page 36). A particularly vicious hen may begin the practice, which may be imitated by others of the flock and continued as a habit.

Treatment.—Allow as much room as possible for exercise. Scratching for feed in deep litter helps to keep the birds busy. Provide a variety of feeds with meat scrap and plenty of green feed and ground oyster shell. The early discovery and isolation of the

principal offenders will frequently check the trouble where it is merely a habit and not due to other causes. If mites are present, treat as for depluming scabies.

TOE PECKING.

Toe pecking is observed in young chicks, especially those confined in brooders. Chicks peck at feed stuck to the foot and wound the skin. The taste of blood causes them to continue pecking at the toes of the victim and to attack other chicks. They may also peck at the vent and disembowel the chick in a short length of time.

Treatment.—Remove all wounded birds as soon as they are observed and isolate them until recovery is complete. Keep the chicks occupied by hanging vegetables or bone with shreds of meat attached at a height which will cause the chicks to jump in reaching them.

IMPACTED CROP (CROP-BOUND).

The affection known as "crop-bound" or impacted crop is an overdistended and paralyzed condition of the crop, generally caused by overeating or by swallowing coarse and indigestible substances, such as feathers or fibrous feeds. In cholera the crop is paralyzed as a result of the disease.

Symptoms.—The first symptom is a loss of appetite, or an effort of the bird to swallow without being able to do so. The crop is seen to be very large and much distended with contents which are more or less firmly packed together. If permitted to continue, the condition becomes aggravated, the breathing difficult, and death may result.

Treatment.—The contents of the crop may be removed sometimes by forcing the bird to swallow a teaspoon or more of sweet oil, and massaging the lower part of the gullet, if it contains feed, or, if not, part of the crop nearest to the gullet, until the contents are softened and may be pressed toward the head. This is made easier by holding the bird head downward. By continued manipulation the greater part of the material may be removed. The bird should not be permitted to eat for several hours after it is relieved. If this plan of treatment is not successful, the crop must be opened with a sharp knife and the contents removed through the opening, using for this purpose a coffee spoon, a buttonhook, small forceps, a bent wire, or other suitable instrument. Then wash out the crop with clean, warm water. The opening should not be more than an inch in length and should be closed with three or four stitches, first in the wall of the crop and, when this is finished, an equal number in the skin. Each stitch should be made and tied separately. Coarse white silk is the best material, but if it is not at hand ordinary cotton thread may be used. Feed on milk and raw egg beaten together for a day or two, and gradually change to soft mash.

INFLAMMATION OF THE STOMACH OR INTESTINES.

Inflammation of the stomach or intestines, when not the result of one of the contagious diseases to which reference has been made, is generally due to digestive troubles or to eating moldy or spoiled feed or irritating mineral poisons. It is indicated by loss of appetite, dull-

ness, and constipation or diarrhea. It may be treated by giving one-half teaspoon of Epsom salt or 2 teaspoons of castor oil, and feeding a soft mash for a day or two.

LIMBERNECK.

The condition known as limberneck is a symptom of several diseases, among which are botulism and ptomain poisoning, which are characterized by a paralysis of the muscles of the neck, which makes it impossible for the bird to raise its head from the ground. This condition is due to the absorption from the crop or intestines of poisons which act upon the nervous system and cause paralysis. It is generally associated with the eating of spoiled feed or putrid meat in which certain poison-producing organisms are growing or of fly maggots which have bred on such material.

Treatment.—The best treatment is to give a full dose of purgative medicine, that is, one-half teaspoon of Epsom salt, or 3 or 4 teaspoons of castor oil for a grown fowl. Unless treatment can be given very soon there is little hope of saving the bird. Spoiled canned goods should not be fed to chickens. Carcasses of fowls or other animals should be burned or buried deep as soon as found.

DIARRHEA.

Diarrhea is present in nearly all the infectious diseases. It may occur, however, independently of the action of infectious organisms.

Cause.—Simple diarrhea may result from digestive disturbances, fermentation in the food passages, moldy feed or putrid flesh, irritants or poisons, too much meat scrap, sudden changes in the feed, or an unusually large quantity of green feed.

Treatment.—Give the entire flock Epsom salt in the proportion of one-half teaspoon to each grown bird. The salt may be mixed in a mash. Correct the feeding.

FAVUS (WHITE COMB).

White comb, baldness, or favus of fowls is a contagious disease that begins with the formation of grayish-white spots on the comb, ear lobes, or wattles (Fig. 9).

Cause.—This disease is caused by a fungus called *Lophophyton gallinæ* and is transmitted from fowl to fowl by simple contact. It is most frequently seen affecting chickens and turkeys, but attempts to infect pigeons have failed. It is also easily inoculated on man, producing large, red, scaly patches on the skin, and the patches sometimes develop spontaneously, being no doubt due to contagion from affected fowls.

Symptoms.—Favus generally begins on the bare parts of the head as small, white, or grayish spots, round or irregular in form, which increase in number and size and join together until the whole surface is covered. The affected spots are covered with dry, scaly, dirty-white crusts with an irregular surface. As the disease advances the neck and body are gradually invaded and the feathers become brittle and break off, leaving a deep depression in the center of a cup-shaped disk. Occasionally the disease is inoculated into

the feathered parts of the skin and begins there instead of on the bare parts of the head, but this is exceptional. The disease when limited to the comb and wattles may disappear without treatment, but after it has invaded the feathered parts it almost invariably continues to advance, and the birds grow weaker until they die from this disease or some other to which their debilitated condition has made them abnormally susceptible.

Treatment.—When only the bare parts of the head are affected the disease may be cured by applying tincture of iodin to the diseased spots. An ointment of calomel 1 part, vaseline 8 parts, or a mixture of soft soap 20 parts, carbolic acid 1 part, may be applied daily. An ointment of red oxid of mercury 1 part, vaseline 8 parts, is also used, as well as olive oil containing 2 per cent carbolic acid. It is essential to separate the affected bird from the flock. If the

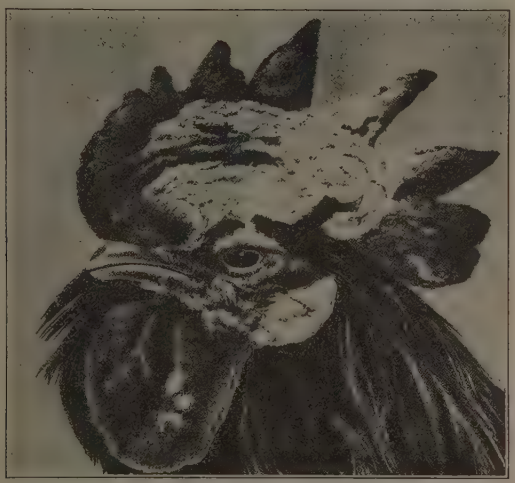

FIG. 9.—Favus ("white comb"). (After Sabouraud.)

feathered parts of the body are affected it is better to kill the bird, as the treatment would be long and expensive and there would be danger of spreading the disease. The disease should be prevented by excluding all affected birds, by burning the bodies of those that die or are killed, and by disinfecting the houses where diseased birds have been.

GAPES.

Gapes is a disease of chickens which develops during the first few weeks of their lives, and is made evident by frequent gaping.

Cause.—It is caused by a parasitic worm (*Syngamus trachealis*) which attaches itself to the internal surface of the windpipe, sucks blood from the mucous membrane, and obstructs the passage to such an extent as to interfere seriously with the breathing. The insufficient supply of air, the loss of blood, and the diminished activity in looking for feed lead to a weak and bloodless condition and often

to death from overcrowding or exposure that a well chick would be able to resist without injury. Sometimes so many worms accumulate in the windpipe that breathing becomes impossible and the chick dies from suffocation (Fig. 10).

The worm which causes this disease is sometimes called the red worm or the forked worm because of its color and of the fact that the male and the female are so firmly grown together that they can not be separated without tearing the tissues. The two worms united in this manner appear at first sight like a single worm with two necks

FIG. 10.—The gapeworm of fowls. (*a*) Windpipe of chick slit open, showing worms attached; (*b*) worms slightly magnified; (*c*) worms greatly magnified. (After Mégnin.)

and two heads. The female is a little more than one-half inch in length and the male one-fifth inch. The heads of both are attached to the mucous membrane, irritating it so much that there is an increased secretion of mucus, which collects and increases the difficulty of breathing.

A large number of eggs develop in the female worm while in the windpipe, and these eggs, microscopic in size, are either thrown out by the chick while sneezing, or are swallowed, pass through the stomach and intestines unharmed, and are scattered with the drop-

pings. After a short period of incubation the eggs contain young worms capable of continuing their development if swallowed by young chickens. These young worms, after hatching out or while still contained in the egg, are swallowed with feed or drinking water. They may live a long time in the soil and sometimes are taken into the digestive tubes of earthworms. In badly infested ground a considerable proportion of the earthworms, if eaten, may be capable of causing the disease in chicks.

These facts explain why ground upon which chickens are raised year after year becomes so badly infested and how the infection is carried over from one year to the next. The worms are carried by turkeys and various kinds of wild birds, which thus help in spreading the infection. When the young worms, or eggs containing sufficiently developed young worms, are taken into the stomach of the chick, the parasites find their way in a few days to the windpipe, where they may be seen already attached and grown to a considerable size within a week.

Symptoms.—The symptoms of gapes are observed most frequently in chicks from 10 days to 4 weeks old. The affected birds cough or sneeze with an abrupt, whistling sound and a more or less labored effect. Very soon they begin to gape, extending the neck and opening the beak, thus indicating that they are not getting a sufficient supply of air. During the first few days the appetite is ravenous, but in spite of the quantity of feed eaten the birds become weak, anemic, and emaciated. Later there is little appetite, the birds are dull, have difficulty in keeping with their companions, and as the disease advances their wings droop and they stand with closed eyes and head drawn back into the body. Frequently the head is thrown forward and the bird gapes or gives the head a convulsive shake in order to loosen the obstruction in the windpipe and permit the entrance of air. In this condition it is liable to die suddenly from suffocation, from exhaustion, or it may be trampled to death by its fellows at night.

The more vigorous and the older birds show only mild symptoms or none at all. They may gape occasionally, but their appetites remain good and they continue to grow. As the soil becomes more and more intensely infested, however, the proportion of the chicks which are able to resist the attacks of the these parasites becomes less, until finally it may be almost impossible to raise chickens on the premises.

Treatment.—Reliance must be placed on prevention rather than cure, because a chick 2 or 3 weeks old has not sufficient value to warrant the expenditure of much time or medicine in its treatment.

Sometimes it is advisable to extract the worms or to inject into the windpipe some liquid that will kill them. Extractors are made in various ways. Generally a small quill feather is stripped of all its web except a small tuft at the end, and is used either dry or moistened with kerosene or oil of turpentine. A fairly good extractor may be made by taking a hair from a horse's tail, bending it in the middle, and twisting the two ends together so as to form a loop; or a similar loop may be made by cutting the hair, laying the two pieces side by side, tying a knot near the end, trimming the short

ends close to the knot, and twisting the long ends together. These homemade extractors have been imitated in the poultry-supply trade by doubling and twisting a small, flexible wire which carries a few moderately stiff hairs to scrape off the worms.

All these extractors are used in the same manner. The chick's beak is forced open with the thumb and fingers of the left hand, while the extractor is held in the right hand. When the glottis, which is the small aperture at the root of the tongue, is opened for breathing, the extractor is carefully inserted and pressed downward into the windpipe. The neck should be kept extended in a straight line, so that the extractor will enter freely and not injure the delicate walls of the windpipe. At the first insertion the loop or brush should not pass more than an inch below the glottis; then it should be given two or three turns between the thumb and finger and withdrawn. If any worms adhere to it they should be dropped into a basin of hot water or kept and burned. The extractor may now be inserted a little deeper, and so on until it reaches nearly the full length of the neck. If the slightest resistance is felt to the entrance of the extractor, it should not be pressed upon or inserted any farther. In all cases the extractor must be quickly withdrawn to avoid suffocating or otherwise injuring the chick. Often 8 or 10 worms may be removed in this manner, and if the treatment has not been so rough as to cause injury the bird will be very much improved.

The best method of prevention is to put the chicks, when hatched, on fresh ground; to remove, place in a separate coop, and treat any that show symptoms, and to plow and seed down the old infected runs, not permitting chickens to go on them for two or three years.

Because turkeys very commonly harbor gapeworms, they are important sources of infection for young chicks, usually unsuspected sources, as they rarely show evidence of the presence of the parasite. When turkeys and chicks are reared together it is difficult to avoid losses from gapes among young chicks.

INTESTINAL WORMS.[2]

Most chickens are infested with one or more species of parasitic worms. These worms may be present in small numbers and may do no apparent damage. If, however, chickens are kept under conditions favoring the spread and multiplication of the parasites (for example, overcrowding in small pens), the fowls may become heavily infested, and in consequence they may be weak, unthrifty, emaciated, and unproductive. Often they show evidence of digestive disturbances in the form of constipation or diarrhea. The nature of the disease may often be determined by examining the birds that die, or by killing one that is very thin and weak. The intestines should be opened with scissors and their contents mixed with water in a dark-colored pan. The white or yellowish worms, which may be more or less cylindrical or threadlike, or flattened and segmented, can then be detected easily, and appropriate treatment applied to the rest of the flock.

[2] The section on intestinal worms (roundworms and tapeworms) was prepared by Maurice C. Hall, of the Zoological Division.

ROUNDWORMS.

Of the various species of roundworms occurring in the digestive tract, two deserve special mention. One of these species is the large roundworm (*Ascaridia perspicillum*, Fig. 11), a white or yellowish worm which occurs in the small intestine and attains a length of from 1 to 4½ inches when fully grown. These worms may be present in such numbers as to block the intestine. The other worm is the cecum worm or heterakid (*Heterakis papillosa*, Fig. 12), a white worm which occurs in the ceca, the two blind guts extending back along the small intestine from its union with the large intestine. This worm attains a length of from three-tenths to one-half inch. These worms are sometimes present in enormous numbers and may cause a serious inflammation of the ceca. They are also of importance, as already noted (page 18), as apparently involved in the causation of blackhead in the presence of infective blackhead material.

FIG. 11.—The large roundworm, *Ascaridia perspicillum*, from the intestine. (After Wickware, 1917.) (Natural size.)

Treatment.—The treatment given below has been recommended by the agricultural eexperiment station of California for the removal of the large roundworm. In experiments carried on in the Bureau of Animal Industry this treatment removed about one-fifth of the cecum worms, and it is not so satisfactory for removing these worms as is the method noted later for their removal. It has, however, the advantage of being a mass treatment and not requiring the handling and treatment of each individual bird, and if repeated at intervals of 3 or 4 weeks it may be of some value in diminishing infestation with cecum worms. The treatment is as follows:

For 100 birds, steep 1 pound of finely chopped tobacco stems for 2 hours in water enough to cover them. Mix the stems and the liquid with one-half the usual ration of ground feed. The day previous to treatment withhold all feed, giving water only. After the birds have been thus fasted for 24 hours, feed the mash thus prepared, and 2 hours after it is cleaned up give them one-fourth of the usual quantity of ground feed mixed with water in which Epsom salt has been dissolved at the rate of 11 ounces for each 100 birds. The treatment should be repeated 10 days later to remove the large roundworms, and, as noted, should be repeated at intervals of from 3 to 4 weeks as a control measure for the cecum worm.

FIG. 12.—The cecum worm, *Heterakis papillosa*, from the ceca. (Natural size.) (From Wickware, 1917.)

The California station has also recommended the following procedure to avoid the necessity of fasting with its consequent fall in egg production: Add 2 per cent by weight of tobacco dust containing at least 1.5 per cent of nicotin to the mash, and feed this mixture

to the flock for a period of 3 or 4 weeks. Too much nicotin diminishes egg production and too little is relatively ineffective.

If a single-dose treatment is desired for the removal of the large roundworm, the California station reports that oil of chenopodium (oil of American wormseed) is more satisfactory than tobacco. It recommends the use of 1 teaspoon of oil of chenopodium, thoroughly mixed with a moist mash, for each lot of 12 birds.

A treatment which was effective in experiments in the Bureau of Animal Industry in removing the cecum worm from chickens consists in the use of rectal injections of oil of chenopodium in a bland oil, such as cottonseed oil. This treatment will remove about 90 per cent of the worms, thereby greatly diminishing the degree of infestation, and if repeated occasionally should serve, in connection with sanitary measures, as an effective control measure. The dose is 0.1 cubic centimeter of oil of chenopodium in 5 cubic centimeters of cottonseed oil for birds weighing 1½ pounds. Probably double this dose would be effective for a bird weighing 3 pounds or more. This mixture may be made up at the rate of 1 teaspoon of oil of chenopodium in 6 fluid ounces of cottonseed oil and given at the rate of one-third of an ounce to birds weighing 3 pounds or more, using a proportionately smaller dose for smaller birds. The two ingredients should be thoroughly mixed and given with a hard-rubber enema syringe, preferably the infant's size syringe. It is as easy to give this treatment by rectum as it is to give a treatment by mouth. The tip of the syringe should be passed along the floor of the cloaca, which is the common passage into which the intestine and the egg tube open, and the mixture injected slowly.

In connection with the use of these treatments or other treatments, preventive measures along the lines of cleanliness and sanitation should be used. The house and yards should be thoroughly cleaned to reduce the chances of reinfestation from worm eggs and larvæ. The fowls should be moved to temporary quarters, and all droppings and loose dirt, and the surface earth to a depth of several inches, removed. The material removed should be placed where the birds can not get at it, since the eggs it contains are very resistant and may retain their vitality for as long as a year, or possibly longer.

It is important that the yards and runs be kept at all times as clean and dry as possible. Droppings should not be allowed to accumulate, and wet spots and puddles of stagnant water should be drained, or the location of the yards changed to a place which can be kept in a sanitary condition. Under some conditions it may be advisable to change the location of the runs occasionally to put poultry on clean areas. Birds that have abundance of range are less liable to become heavily infested, all other things being equal, than those which have a very limited range.

TAPEWORMS.

There are several species of tapeworms which occur in fowls, and one or more species may be found in many of these birds. These worms are white and flat and are divided into joints or segments. They occur in the intestines and are sometimes present in such large numbers as to cause serious injury or even the death of the infested

animal. Some of these tapeworms are rather large and are not easily overlooked, but others are very small (Fig. 13) and may be overlooked unless looked for very carefully. One of the larger worms, known as the spiny-suckered tapeworm (*Davainea echinobothrida*, Fig. 14), is of especial interest because it produces in the intestine small nodules which closely resemble the nodules caused by tuberculosis. If intestinal nodules are found in birds infested with tapeworms, and if the liver is not affected and other symptoms of tuberculosis, such as lameness, are not present, the condition may be suspected of being due to tapeworms. This may be confirmed by an examination of the nodules on the inside of intestine, after slitting it open, with the finding of the tapeworms attached by the head to the mucous surface at the site of the nodule.

FIG. 13.—The sphenoid tapeworm, *Amœbotænia sphenoides*, from the small intestine. Magnified 22 times. Actual length of worm less than one-fifth inch. (From Meggitt, 1914.)

Tapeworms in poultry are especially injurious to young birds and are apparently more prevalent in wet years than in dry years, and in the case of birds kept in damp places than in the case of those kept in dry places. They cause intestinal catarrh, diarrhea, droopiness, loss of appetite, and emaciation.

Treatment.—At the present time it is impossible to make definite recommendations in regard to the treatment of poultry for tapeworms. A number of treatments have been tested in the Bureau of Animal Industry, but no treatment thus tested has been very effective. A method of treatment which has been recommended by the Oklahoma experiment station and has the advantage of being a mass treatment, is as follows:

FIG. 14.—The spiny-suckered tapeworm, *Davainea echinobothrida*, the cause of worm nodules on the small intestine. (Entire worm, natural size.) (From Ransom, 1905.)

A gallon of a mixture of wheat and oats, to which is added a small tablespoon of concentrated lye, is cooked slowly for about 2 hours and allowed to cool. The birds are fasted for 15 hours and then given as much of the mixture as they will eat, with plenty of water.

The life history of chicken tapeworms is not known in all cases, but so far as these life histories are known they involve animals other than birds which are the necessary intermediate hosts of the worms. The eggs produced by the tapeworm in the intestine of the chicken pass out in the droppings and are eaten by small invertebrate animals, such as insects, slugs, earthworms, etc., and hatch in these animals, developing to minute larval tapeworms. When these infested insects or other intermediate hosts are eaten by chickens the larval tapeworms develop to the adult tapeworms in the intestines of the chickens. From the nature of these life histories it follows that chickens can not become infested with tapeworms as a result of eating the worm eggs passed in the droppings, as they can in the case

of roundworms. It is usually out of the question to prevent birds from eating insects and similar small animals, so that prevention is largely a matter of disposing of the droppings of poultry in such way that the tapeworm eggs in these droppings can not infect the intermediate hosts, or at least can not infect those in the vicinity of the areas on which poultry is kept. To this end the droppings should be removed often and disposed of at some distance from these areas, thus reducing the chance of infecting intermediate hosts that may be eaten by poultry. In general the sanitary measures noted for the control of roundworms are of value for the control of tapeworms.

LICE.[3]

There are at least seven different species of lice occurring on domestic chickens, while still other forms occur on turkeys, ducks, and guinea fowls. As different species of lice are usually confined to different parts of the body, they are commonly referred to as head lice, tail lice, wing lice, and body lice, although the distinction is not very exact, since the various species intermingle to some extent.

Lice powders and their application.—Experiments by the Bureau of Entomology have shown that a very satisfactory way of eliminating lice from poultry is to treat each fowl separately with sodium fluorid. If thoroughly applied one treatment is sufficient. Commercial sodium fluorid may be purchased at most drug stores at from 30 to 60 cents a pound and may be applied either by the so-called "pinch" method, or by means of a duster made by punching small nail holes in the bottom of a can having a tight-fitting cover, or by dipping. If the pinch method is used, the bird is held on a table while sodium fluorid is applied next to the skin under the feathers, as follows: One pinch under the head, one on the neck, two on the back, one on the breast, one below the vent, one on the tail, one on each thigh, and one on the underside of each wing. The feathers should be ruffled to allow the powder to get next to the skin. If the bird is held in a large, shallow pan, the small quantity of powder which falls off will be saved. If the powder is dusted on by means of a shaker the amount of sodium fluorid used may be reduced by using 4 parts of road dust or flour to 1 part of the chemical. This method requires the services of a second person to hold and turn the fowl.

When large numbers of birds are to be treated the sodium fluorid may be used in the form of a dip, using 1 ounce of commercial sodium fluorid to each gallon of water. The birds should be held by the wings and plunged into a tub full of the solution, leaving the head out, while the feathers are ruffled with the hand to allow the solution to penetrate to the skin. The head is then ducked once or twice and the bird allowed to stand a minute to drain and then released. Dipping is just as effective as the other methods, but should be used with care. It is not advisable to dip very weak or young birds, especially in cold or damp weather. The use of the dipping method is advised only during warm and sunny days.

[3] For additional details see Farmers' Bulletin 801, Mites and Lice on Poultry.

One pound of sodium fluorid will treat 100 birds by the pinch method. Figuring a person's time at 40 cents an hour and the drug at 40 cents a pound, it has been estimated that it costs about $2 to treat 100 fowls.

Another good lice powder is flowers of sulphur, which should be applied with a duster. Although sulphur is considerably cheaper than sodium fluorid, it is less effective against lice and hence must be applied more liberally, so that a treatment with sulphur is in reality more expensive than with sodium fluorid. Many other powders, most of which contain pyrethrum (insect powder) are commonly used, but they have no advantage over sodium fluorid.

Dust baths containing a mixture of tobacco dust or other insecticides and ordinary road dust are often recommended to destroy lice. While it is a good plan to let the birds dust themselves when they wish, no method which allows the bird to treat itself for lice can be expected to eradicate them all, since fowls can not get the dusting powder on all parts of the body where lice are, and many lousy birds will not use the dust bath.

It is possible and practicable to keep a flock of poultry absolutely free from lice and mites, and this should be the aim of every one who is endeavoring to establish a successful poultry industry.

MITES.[4]

COMMON RED MITE.

While there are many kinds of mites affecting poultry, there are three which are of special importance to poultry raisers, the best known being the common chicken mite or red mite (*Dermanyssus gallinæ* De Geer). In the Northern States this mite is dormant in winter, except in chicken houses which are heated, but in the South it breeds and is active the year round, although it is always most abundant in summer. Unlike the other mites affecting poultry, this parasite is found on the birds only when it is feeding. It is nocturnal in habits, feeding at night and hiding during the day in the cracks of the roosts, in the nests, in the corners of the floor, or between boards. For this reason its presence often remains undetected until the chicken houses are badly infested and the poultry raiser seeks an explanation for the drooping condition and listlessness of his fowls.

Treatment.—To eradicate the pest a thorough cleaning of the chicken houses and spraying with a suitable disinfectant having a sufficient body is all that is necessary. All roosts, loose boards, and boxes should be removed and the disinfectant applied in the form of a rather coarse spray, using a suitable pump. One of the best substances for the purpose is anthracene oil. As this is a little too heavy to spray well, it may be thinned with an equal part of kerosene. High-grade creosote also gives satisfactory results. Crude petroleum is almost equally effective and is usually cheaper. It should be thinned by adding 1 part of kerosene to 4 parts of crude oil. Pure kerosene, kerosene emulsion, and carbolic acid are all effective, but

[4] For additional details see Farmers' Bulletin 801, Mites and Lice on Poultry.

as they all lack sufficient body for persistence the spraying must be repeated several times at 10-day intervals. The coal-tar dips, used in a slightly stronger solution than recommended on the labels, will be effective if the application is repeated, and their germicidal properties are a desirable feature. Whatever preparation is used the birds should be kept out of the houses until the fluid has thoroughly soaked into the wood.

DEPLUMING SCABIES.

Fowls and pigeons are sometimes infested by an itch mite which lives at the base of the feathers, causing an intense itching and producing a disease known as mange or depluming scabies. The irritation caused by the mites leads the fowls to pull out their feathers, and they often acquire the habit of feather pulling, attacking the plumage of other birds as well as their own. If the stumps of the feathers are examined soon after the breaking of the quill, they will be found surrounded by scales and crusts, and the adjoining feathers when pulled out will be found similarly affected. In this way the condition can easily be distinguished from molting or the vice of feather pulling, which fowls sometimes acquire without apparent cause. The mites causing the disease are introduced into the poultry yard by affected fowls and spread rapidly from fowl to fowl, finally infesting nearly all in the flock. The disease usually begins in the spring, is most active in warm weather, and largely disappears in winter.

Treatment.—The affected spots of the skin from which the feathers have dropped, and for some distance around them, should be anointed with an ointment made by thoroughly mixing 1 part of flowers of sulphur with 4 parts of vaseline or lard, or 1 part of carbolic acid with 50 parts of vaseline. A convenient liquid preparation is made by mixing Peruvian balsam, 1 ounce, and alcohol, 3 ounces. One of these preparations may be selected and applied at least twice, with an interval of a week or 10 days. It has been reported that both depluming mites and lice may be eradicated with one treatment by dipping in the following solution: Sodium fluorid, ¾ ounce; sulphur, 2 ounces; laundry soap, ½ ounce; water, 1 gallon. The dip should be kept stirred so as to keep the sulphur in suspension.

SCALY LEG; MANGE OF THE LEG.

Another species of itch mite attacking chickens, turkeys, pheasants, and cage birds is the cause of a condition known as scaly leg. While this mite is usually confined to the legs, it may occasionally attack the comb and wattles. The disease occurs in most cases as a result of association with infected birds. It spreads slowly, and many individuals escape it entirely, although constantly exposed to it. (Fig. 15.)

Symptoms.—The disease is easily recognized by the enlargement of the feet and legs and the rough appearance of the surface of the feet. The parasite begins its attack in the clefts between the toes and gradually spreads forward and upward until the whole of the foot and the shank become affected. The two legs are usually attacked about the same time and to the same degree. At first there is only

a slight roughening of the surface, but the continued irritation by the mite causes the formation of a spongy or powdery substance beneath the scales, which raises them more and more until they are nearly perpendicular to the surface and are easily detached. In the most severe cases the joints become inflamed, the birds are lame and scarcely able to walk, a joint or an entire toe may be lost, and the birds, unable to scratch for feed, lose flesh and die from hunger and exhaustion.

Treatment.—In the treatment of scaly leg it is advisable to smear the roosts with wood preserver or crude petroleum as a precaution-

FIG. 15.—Scaly leg.

ary measure to prevent the further spread of the disease. The uninfested birds should be isolated from the infested, and the latter should have their legs washed with soap and warm water, removing all loose scales. Dry the legs and apply an ointment containing 2 per cent carbolic acid or the sulphur ointment or the Peruvian-balsam wash previously mentioned. Another good remedy well recommended is made by mixing oil of caraway 1 part with vaseline 5 parts, or the caraway oil may be mixed with 5 parts of castor oil and rubbed gently into the skin. Some poultrymen who have large numbers of birds to be treated make a mixture of one-half pint of kerosene and 1 pint of raw linseed oil in a quart can, take it to the poultry house at night, and dip both legs of each affected bird into the mixture, allowing them to drip into the can for a minute after

removal, and then replace the chicken on the roost. The feathers of the leg must not be wet, as it causes irritation and sometimes burns the skin. Crude petroleum is equally effective used in the same way. The treatment should be repeated in three or four days.

OTHER MITES.

Several other species of mites infest poultry. One of these bores into the skin and is found in cysts lying on the under surface of the skin next to the muscles. This form is not known to do any serious injury. Another species occurs in the air passages, liver, and lungs of chickens. Unless present in sufficient numbers to interfere with breathing, it is not a serious pest. Still other mites live among the feathers of the birds, sometimes causing an unsightly appearance of the feathers, but apparently cause little injury to the birds themselves.

Feather mites may be destroyed by dipping affected fowls in the sulphur solution recommended for the treatment of depluming scabies.

CHIGGERS, OR HARVEST MITES.

Chiggers, harvest mites, or "red bugs," which so frequently annoy campers by the intense itching they produce, may also attack fowls. Young chickens having a free range, especially if it includes low-lying lands, are the most liable to suffer from these parasites. The mites penetrate the skin, causing an intense itching, and abscesses may be found where clusters of mites are feeding. These abscesses are sometimes a third of an inch in diameter, surrounded by an area of inflammation. The birds become droopy, refuse to eat, and may die from hunger and exhaustion.

Treatment.—If an abscess has not yet formed the inflamed area may be treated with sulphur ointment, Peruvian balsam, or a mixture of 1 part of kerosene with 3 parts of lard. If suppuration has occurred the scab should be removed and the area washed with 4 per cent carbolic-acid solution. Frequent light dusting with flowers of sulphur will keep the chickens from becoming infested. In the Southern and Central States, where harvest mites are most numerous, it is often necessary to keep young chickens off the range in summer. In these sections it is a good plan to hatch the chicks early in the spring, so that when the warm weather comes, in which the mites are most abundant, the birds will be old enough to resist their attacks.

TICKS.[5]

In some parts of the South poultry are commonly infested with a species of tick known as the chicken tick or adobe tick (*Argas miniatus*). This parasite when full grown may be from one-fifth to one-fourth of an inch long, and is a powerful bloodsucker. In its adult stage of development it has feeding habits similar to the much smaller red mite in that it feeds only at night and spends the day hiding in cracks in the floors or walls. Pigeons are occasionally attacked by a similar tick, and both species have been known to inflict painful bites on persons coming in contact with infested birds.

[5] For additional details see Circular 170, Bureau of Entomology, The Fowl Tick.

These ticks, on account of their relatively large size compared with mites, can do a great deal of damage in a poultry or pigeon house, and young birds attacked by them are liable to succumb to exhaustion from loss of blood. Moreover, in the case of the chicken tick, it is known that in some countries this parasite may itself be parasitized by minute organisms which are injected into the blood of the fowl which it attacks, causing a severe and usually fatal fever. In this way the tick acts as a carrier of the disease organism much as the mosquito by its bite carries the organism causing malaria to man.

The earlier stages of the chicken tick's development are passed entirely on the body, the tick leaving the birds only when it approaches the adult stage; but thereafter the adult tick attacks chickens only at night, after they have gone to roost.

Treatment.—Chicken ticks are very persistent, and ordinary insecticides have little effect on them. If a chicken house is found to be infested with ticks, the chickens should be removed from it and housed in temporary coops for a period of 10 days at some distance from the chicken yard. This period of quarantine allows the young ticks that are present on the chickens to become engorged and fall off. If the chicken house is badly infested and is not of much value, it should be destroyed by burning. Otherwise, an attempt to disinfect it may be made after all loose boards and boxes which may provide hiding places for the ticks have been removed. Then crude petroleum or wood preservative may be applied as recommended for the treatment of red mites. The temporary coops in which the chickens have been quarantined should be burned or disinfected with boiling water.

A simple and inexpensive way of protecting chickens from the attacks of ticks is to provide readily demountable roosts direct from the floor and not touching the walls, or to suspend the roosts from the ceiling by means of small wires. The roosts are prevented from swaying by similar wires between the roosts and the walls of the house. Nests should be located away from roosting places. If constructed of metal they can be disinfected quickly from time to time by burning out the straw.

Metal houses have been found to be effective in dealing with the ticks, as even without special attention they remain practically tick free, and if necessary they can be disinfected easily by a fire of straw, paper, or other light material, after removal of the roosts. Metal houses, however, are usually more expensive than wooden ones, and are hot in summer and cold in winter. If they are used in summer the fowls should be provided with shade outside the house.

When ticks have once been eradicated from the premises no chickens should be added to the flock until they have been quarantined for 10 days in temporary coops, as already described. The coops should be destroyed after use, or thoroughly disinfected with hot water.

FLEAS.[6]

In the Southern and Southwestern States poultry are frequently infested by a species of flea known as the chicken flea, or stick-tight

[6] For additional details in regard to chicken fleas see Farmers' Bulletin 683, Fleas as Pests to Man and Animals, with Suggestions for Their Control.

flea, so called from its habit of remaining attached to one place. This form also attacks dogs, cats, and some wild animals. On poultry the fleas are usually found in clusters on the comb, wattles, and around the eyes; on dogs they are found on the ears. Young fowls when heavily infested often die quickly. Older birds, while more resistant, have been known to succumb to heavy infestations, and even mild infestations will reduce egg laying and retard the growth of the fowls.

Treatment.—As a preliminary step in the treatment of fleas, all dogs and cats should be kept away from the chickens and should never be allowed to lie on the ground in the chicken yards. As rats frequently harbor large numbers of these fleas and may therefore keep up the infestation, they should be destroyed by trapping, not only on account of the fleas they may carry but because they are themselves a serious pest to poultry. Chicken fleas breed in the cracks of the henhouses, and it is accordingly necessary to treat both the birds and their quarters. The combs and wattles of the birds may be anointed with carbolated vaseline or sulphur ointment. Great care should be taken, however, not to get any of the ointment in the birds' eyes, as it may produce blindness. The henhouses and yards should be thoroughly cleaned out, sprayed with creosote or other suitable disinfectant, and may then be whitewashed with lime and carbolic acid as already recommended for mites.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Secretary of Agriculture	HENRY C. WALLACE.
Assistant Secretary	C. W. PUGSLEY.
Director of Scientific Work	E. D. BALL.
Director of Regulatory Work	
Weather Bureau	CHARLES F. MARVIN, *Chief.*
Bureau of Agricultural Economics	HENRY C. TAYLOR, *Chief.*
Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Bureau of Plant Industry	WILLIAM A. TAYLOR, *Chief.*
Forest Service	W. B. GREELEY, *Chief.*
Bureau of Chemistry	WALTER G. CAMPBELL, *Acting Chief.*
Bureau of Soils	MILTON WHITNEY, *Chief.*
Bureau of Entomology	L. O. HOWARD, *Chief.*
Bureau of Biological Survey	E. W. NELSON, *Chief.*
Bureau of Public Roads	THOMAS H. MACDONALD, *Chief.*
Fixed Nitrogen Research Laboratory	F. G. COTTRELL, *Director.*
Division of Accounts and Disbursements	A. ZAPPONE, *Chief.*
Division of Publications	EDWIN C. POWELL, *Acting Chief.*
Library	CLARIBEL R. BARNETT, *Librarian.*
States Relations Service	A. C. TRUE, *Director.*
Federal Horticultural Board	C. L. MARLATT, *Chairman.*
Insecticide and Fungicide Board	J. K. HAYWOOD, *Chairman.*
Packers and Stockyards Administration *Grain Futures Trading Act Administration*	CHESTER MORRILL, *Assistant to the Secretary.*
Office of the Solicitor	R. W. WILLIAMS, *Solicitor.*

This bulletin is a contribution from

Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Pathological Division	JOHN S. BUCKLEY, *Chief.*

41

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY

PURCHASER AGREES NOT TO RESELL OR DISTRIBUTE THIS COPY FOR PROFIT.—PUB. RES. 57, APPROVED MAY 11, 1922

▽

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923